

# Biodiversity

## The Foundation for Environmental, Social and Economic Prosperity in Nova Scotia

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A PANEL OF EXPERTISE REPORT ON BIODIVERSITY TO THE STEERING PANEL  
February 2010



Canada Lynx (*Lynx canadensis*) - Endangered (2002)—Province of Nova Scotia

## BIODIVERSITY PANEL OF EXPERTISE

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This report was authored by the Biodiversity Panel of Expertise as part of the Nova Scotia Natural Resources Strategy 2010 process. Panel members include:

Cliff Drysdale, BSc, MSc

K. Martha M. Jones, BSc, MSc, PhD

Stephen Mockford, BSc, PhD

Liaison: J. Sherman Boates, BSc, MSc, PhD

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# EXECUTIVE SUMMARY

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Nova Scotia is rich and diverse in terms of its land, sea, people, history, geography, geology and wild plants, animals and ecology. Natural resources such as forests, lakes, marshes, beaches, and plant, animal, and microbial species underpin the quality of life that is the foundation of who we are as Nova Scotians.

Biodiversity is the way that scientists have come to describe the variety of life on earth. It is defined in the Canadian Biodiversity Strategy as the variety and interconnectedness of life, including all species of plants, animals, and other organisms, the genes they contain, and the ecosystems and ecological processes of which they are a part. Biodiversity and the quality of human life are tightly intertwined.

It is important to consider how our own health and prosperity centres on applying the principle of sustainability: working to integrate and balance social, economic and environmental priorities, now and for future generations. Consequently the protection and sustainable use of biodiversity forms a significant part of the background against which government decisions are made.

Factors affecting Nova Scotia's biodiversity are influenced by a changing natural, economic, and social environment. Many threats such as climate change, the long range transport of air pollutants, and a global economy, are outside of the direct control of the Government of Nova Scotia. Other activities are regulated by various government jurisdictions, such as invasive alien species. However, all of these threats contribute to the context within which our government makes decisions.

Issues related to the conservation and sustainable use of biodiversity cross divisional boundaries within the Department of Natural Resources, departmental boundaries within the Government of Nova Scotia, and jurisdictional boundaries with other levels of government. Despite this, there is no lead authority or biodiversity legislation to champion biodiversity issues in Nova Scotia.

The accuracy, availability and completeness of biodiversity information in the province is also a concern, as lack of access to information impacts the ability of scientists, political leaders, and others to make informed decisions related to the conservation and sustainable use of biodiversity in Nova Scotia.

While government, industry, and non-governmental organizations have a significant role to play in developing and implementing policy, strategy, and programs that aim to protect the province's biodiversity, it is individual Nova Scotians who will form the front line to conserve biodiversity on privately held lands, and hold government and industry accountable for the stewardship of natural resources on public lands.

In order for this to happen, Nova Scotians need to understand biodiversity and how we benefit from the ecological services provided to us by properly functioning natural systems. Based on a more comprehensive understanding of biodiversity and its benefits, individual Nova Scotians must be engaged by government, industry, and non-governmental organizations to participate in the conservation and management of biodiversity, resulting in co-ordinated stewardship of our natural resources.

To achieve a vision of a Nova Scotia rich and diverse in healthy native biodiversity, and citizens who understand, value, and strive to maintain biodiversity, the Biodiversity Panel has identified a number of recommendations in the areas of: governance, leadership and legislation; biodiversity knowledge; conservation of biodiversity, sustainable resource use and threats to biodiversity; and education, engagement, and stewardship. These key areas of recommendation can be summarized in the following points:

- Nova Scotia needs a Biodiversity Act and other regulatory and stewardship tools, designating the Department of Natural Resources as the lead department and the departments of Agriculture, Environment, Fisheries and Aquaculture, and Energy as key departments.
- Informed decision making could be greatly enhanced with the coordination and establishment of an external science advisory body, and further development of internal scientific expertise to provide advice to the minister based on the most up-to-date scientific understanding of issues affecting biodiversity.
- The Government of Nova Scotia should strive to enhance public understanding of the importance of protecting biodiversity, soil, water, and air quality and in collaboration with land owners, industry, non-governmental associations, and educational institutions.

- A co-operative effort is required to survey and monitor biodiversity and manage data storage, organization, and distribution for spatially referenced biological and physical information for the Province of Nova Scotia. This effort should be led by the Department of Natural Resources.
- A biodiversity education program including age-appropriate, experiential curriculum should be developed by the province to address biodiversity and ecological goods and services across all grades from primary to grade 12 in order to develop a new generation of stewards for our province's natural resources.

## 1.0 INTRODUCTION

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“The status quo cannot sustain the biodiversity of our natural environment, enhance the economy, or preserve the rural lifestyle so valued by the citizens of this province.”—Our Common Ground: The Future of Nova Scotia's Natural Resources 2009

Nova Scotia is a unique part of the planet, rich and diverse in terms of its land, sea, people, history, geography, geology and wild plants, animals and ecology. Because of our long history, our reliance on natural resources and our close ties to the land and water, we are very much in touch with the natural environment and care deeply about it. The forests, lakes, marshes, beaches, wildlife, plant, and animal species underpin the quality of life that is the foundation of who we are as “Nova Scotians.”

Over the last two decades, our society and many others have begun to focus on the principle of sustainability: working to integrate and balance social, economic, and environmental priorities. Nova Scotians want quality of life in its broadest sense now, but not at the expense of future generations.

Recent provincial government initiatives have addressed aspects of sustainability and quality of life for Nova Scotians including: an updated economic growth strategy (*Opportunities for Sustainable Prosperity 2006*), a new provincial heritage strategy (*A Treasured Past, A Precious Future*) and the Environmental Goals and Sustainable Prosperity Act (EGSPA).

Nova Scotia aims to: “achieve international recognition for having one of the cleanest and most sustainable environments in the world by the year 2020.”—Environmental Goals and Sustainable Prosperity Act 2007

The Natural Resources Strategy 2010 initiative will contribute to our progress on integrating sustainability into our lives by explicitly addressing four key areas: Forests, Minerals, Parks, and Biodiversity. For the first time, Nova Scotia will formally have strategic direction and recommendations for the conservation and use of biodiversity.

## 1.1 Defining biodiversity

The concept of biodiversity is central to the challenge of implementing sustainability. The Canadian Biodiversity Strategy defines biological diversity—or biodiversity—as the variety and interconnectedness of life, including all species of plants, animals, and other organisms, the genes they contain, and the ecosystems and ecological processes of which they are a part. Biodiversity and the quality of human life are tightly intertwined.

### Examples of biodiversity and habitats from Nova Scotia

**Species:** red spruce, yellow birch, cranberry, mayflower, Atlantic salmon, lobster, blue jay, bald eagle, moose, chipmunk, soft-shelled clam, rockweed, piping plover, *Euvira Micmac* (a beetle) and many many more. Along with these plant and animal examples, there are extraordinary and unexplored communities of microbes in Nova Scotia.

**Ecosystems:** sand dunes, lakes and rivers, white-pine and red-oak forest, bogs, swamps, heath barrens, caves, cliffs, alder swale, saltmarsh, and many more.

**Ecological processes:** soil formation, nutrient cycling, pollination, predation, forest succession, decomposition, and many more.

**Genes:** unique genetic forms of shrews and turtles, diverse forms of raspberry and blackberry, many coastal and marine organisms with potential pharmaceutical potential, varieties of apples, Nova Scotia duck toller, and more.

## 1.2 Biodiversity loss and threats

The “biodiversity crisis” is the term used to describe the substantial and widespread loss of species, genetic resources, ecosystems, and ecological process disruption. It profoundly affects the functioning of the planet and, in turn, all living things. The decline of global biodiversity has increased exponentially over the past 100 years and the current rate of extinction is 1,000 times greater than historical rates (*Millennium Ecosystem Assessment 2005*).

### Global Biodiversity in Decline:

- Half of the world’s wetlands have been lost in the last century.
- The world’s forests have shrunk by half.
- Seventy per cent of the world’s marine stocks are being over-fished.
- Twenty per cent of the world’s freshwater species are at risk.

—Adapted from Millennium Ecosystem Assessment 2005

The current major threats to biodiversity are: pollution, unsustainable exploitation of resources, climate change, habitat loss and degradation, and invasive species. Human population growth and over-consumption are the two significant and over-arching threats to biodiversity.

Also tied to the biodiversity crisis is the observation that people, especially children, no longer have basic connections with nature as a basis for their own health and enjoyment, responsible environmental behaviour, and their roles as stewards of biodiversity and the environment.

## 1.3 The value of biodiversity

Biodiversity is integral to a region’s long-term sustainable economic development and its capacity to remain globally competitive. People directly and indirectly receive substantial benefits and services from biodiversity.

A large portion of our provincial economy is dependent on natural resources from forests, oceans, and agricultural lands. These many important direct benefits include the harvest of fish, trees, deer, waterfowl, berries, maple syrup, and other products. Yet these are now thought to be only a fraction of the benefits that we derive indirectly from biodiversity.

People have begun to pay more attention and realize the value of these benefits and often refer to them as “ecosystem goods and services” and “natural capital”. Ecosystem goods and services is a phrase now used to describe the wealth of benefits that people receive from nature, including food, raw materials, clean water, clean air, recreational opportunities, and spiritual well-being.



**Ecosystem goods:** products derived from natural systems that are harvested or used by people.

**Ecosystem services:** ecological processes that form the subset of ecosystem functions that benefit people.

*Department for Environment, Food and Rural Affairs (UK) 2007*

The *Millennium Ecosystem Assessment* (2005) categorizes ecosystem goods and services as follows:

**Provisioning:** such as food, fresh water, fuel, and fibre

**Regulating:** such as climate, water, and disease regulation, as well as pollination

**Supporting:** such as soil formation and nutrient cycling

**Cultural:** such as educational, aesthetic, and cultural heritage values, as well as recreation and tourism

*Opportunities for Sustainable Prosperity 2006: Nova Scotia's Economic Growth Strategy* highlighted strategic elements for economic prosperity, and identified five "building blocks of productive capacity." These include financial, natural, built, human, and social capital. Biodiversity is essentially the natural capital depicted in the province's economic growth strategy. Although presented on equal level with the other kinds of capital, biodiversity, or natural capital, is actually the foundation of much of the other capital.

## 1.4 The precautionary principle

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A foundational principle of the biodiversity approach and key component of biodiversity policy and strategy from the Earth Summit onward is the precautionary principle.

"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation."—United Nations Convention on Biological Diversity 1993

The precautionary principle is a necessary part of any biodiversity strategy, and of efforts to conserve and sustainably use biodiversity in Nova Scotia. This principle obliges policy makers to respond to threats to biodiversity without the need for absolute scientific proof and to be cautious with actions that may harm the environment or the public good.

## 1.5 Towards a Nova Scotia biodiversity strategy

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Since the early 1990s, Nova Scotia has used the United Nations Convention on Biological Diversity (CBD) and the Canadian Biodiversity Strategy to guide its management and conservation of biodiversity in Nova Scotia.

The Convention on Biological Diversity came into force on December 29, 1993. Canada was the first industrialized country of 189 jurisdictions to sign and ratify the CBD. The objectives of this convention include the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits arising out of the utilization of genetic resources.

The Canadian Biodiversity Strategy (1995) addresses the implementation of the Convention on Biological Diversity in Canada. This strategy has five goals. Addressing or complementing the goals are over one-hundred-and-forty recommendations to guide the implementation, conservation, and sustainable use of biodiversity by Canadians.

## Five Goals of the Canadian Biodiversity Strategy:

1. To conserve biodiversity and use biological resources in a sustainable manner.
2. To improve our understanding of ecosystems and increase our resource management capability.
3. To promote an understanding of the need to conserve biodiversity and use biological resources in a sustainable manner.
4. To maintain or develop incentives and legislation that support the conservation of biodiversity and the sustainable use of biological resources.
5. To work with other countries to conserve biodiversity, use biological resources in a sustainable manner, and share equitably the benefits that arise from the utilization of genetic resources.

While the international and national documents are relevant and should be useful at the provincial/territorial level, there are clear benefits to adapting and developing a strategic plan at the provincial scale. British Columbia, Alberta, Saskatchewan, New Brunswick, Quebec, Ontario, and the Northwest Territories have so far developed biodiversity strategies. These strategies have aligned the general issues surrounding biodiversity conservation and sustainable use with their particular local needs and priorities.

This year (2010) is the United Nations International Year of Biodiversity. Many governments, organizations, and individuals will increase efforts to slow the widespread and catastrophic loss and degradation of biodiversity, as well as to celebrate the wonder and diversity of the plants, animals, ecosystems, and processes that make up the living world.

In this International Year, we must counter the perception that people are disconnected from our natural environment. We must increase understanding of the implications of losing biodiversity. In 2010, I call on every country and each citizen of our planet to engage in a global alliance to protect life on Earth. We must generate a greater sense of urgency and establish clear and concrete targets.

Biodiversity is life. Biodiversity is our life.

—Ban Ki-Moon, Secretary General of the United Nations

The Nova Scotia Natural Resources Strategy 2010 process will provide the foundation for the first provincial biodiversity strategy. The strategy will help provide Nova Scotians with a healthier environment, healthier communities, more competitive industries, and a better future for our children and grandchildren.

## 1.6 Biodiversity vision for Nova Scotia

An important part of achieving adequate conservation and sustainable use of biodiversity will involve identifying and implementing a clear and common biodiversity vision for Nova Scotia.

The Canadian Biodiversity Strategy has the following vision:

“A society that lives and develops as part of nature, values the diversity of life, takes no more than can be replenished and leaves to future generations a nurturing and dynamic world, rich in its biodiversity.”

—Vision of the Canadian Biodiversity Strategy 1995

Just as Nova Scotia needs its own biodiversity strategy, there should be a biodiversity vision for the province. The panel’s proposed biodiversity vision for Nova Scotia is:

A Nova Scotia rich and diverse in healthy native biodiversity; and Nova Scotians who understand, value, and strive to maintain and share biodiversity and its many benefits now and in the future.



## 1.7 Biodiversity objectives for Nova Scotia

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A biodiversity strategy for Nova Scotia must have clear objectives. The Biodiversity Outcomes Framework was developed through the co-operative efforts of provinces, territories, and the federal government. It is being used to identify and link current and future priorities, to engage Canadians and to report on progress. The framework also establishes concise, common, high-level biodiversity outcomes. These biodiversity outcomes need to be part of Nova Scotia's biodiversity strategy. They will help focus on what we want to achieve in biodiversity and social terms, as well as provide general measures of our success in the conservation and sustainable use of biodiversity in Nova Scotia.

### Biodiversity Outcomes - What We Want to Achieve in Nova Scotia

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**Healthy and Diverse Ecosystems:** Reducing human impacts and restoring damaged ecosystems enhance the productivity and resilience of our ecosystems and preserve the goods and services essential to our well-being.

**Viable Populations of Species:** Maintaining the structure and function of ecosystems requires the full complement of native species. Conservation at the ecosystem level sustains most species, but special efforts are needed for some.

**Genetic Resources and Adaptive Potential Maintained:** Genetic diversity is nature's insurance policy. It makes increased production, assures ecological resilience, and creates options for future innovation.

**Sustainable Use of Biological Resources:** Ecologically sustainable production and consumption of natural resources assure stable jobs, traditional lifestyles, long-term food security, and human health.

*—Adapted from Biodiversity Outcomes Framework for Canada, 2006*

## 2.0 BIODIVERSITY IN NOVA SCOTIA: GENES, SPECIES, AND ECOSYSTEMS

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Nova Scotia is rich in its variety of species, ecosystems, genetic diversity, and related ecological processes. Biological diversity in an area is determined by numerous factors including evolution, geology, climate, geography, hydrology, predation, competition, vegetation, and human activities.

### Species

Nobody knows how many species of animals, plants, and other organisms are on the planet, or for that matter precisely how many there are in Nova Scotia. There are tens of thousands of species in the province but we have information on only a few thousand. Some species found in Nova Scotia are found nowhere else in the world. For example, the Atlantic whitefish only breeds in the Petite Riviere watershed. Nova Scotia has a special global responsibility to take care of rare species, and those at risk of extinction. Some, such as the Atlantic whitefish, are species at risk.

Animal species including fish, mammals, and birds used in hunting and trapping are a key aspect of sustainable use of biodiversity. For centuries in Nova Scotia, species such as the moose, white-tailed deer, snowshoe hare, black duck, and brook trout have provided valuable food, products, employment, and recreation for many people. Nova Scotia continues to rely on marine biodiversity as important sources of food and livelihood.

Plants are also important components of the sustainable use of biodiversity in Nova Scotia. Tree species including red spruce, balsam fir, and sugar maple are common sources of lumber, pulp, firewood, and other forest products. Cranberries, blueberries, and other plant fruits are important food sources. Agricultural crops and livestock, although generally not native to our area, are important components of biodiversity. These traditional-use species have long been the focus of management and conservation programs. Studies and population monitoring together with harvest regulation aim to ensure that uses of these resources are sustainable.

## Ecosystems

Ecosystem is a term used to describe a community of plants, animals, microorganisms, and other organisms that are linked by energy and nutrient flows and that interact with each other and with the physical environment. Lake, bog, forest, beach, salt marsh, swamp, and barren are all examples of ecosystems. Nova Scotia has much to offer the world in terms of special ecosystems given its geographic position and climate.

Biodiversity is best addressed at a variety of scales: small to large and short-term to long-term. It is therefore essential to work together across boundaries to ensure that we plan and manage appropriately for the conservation and sustainable use of biodiversity.

There has been an emphasis on developing systems of protected areas that serve as largely unaltered systems of species, genes, ecosystems, and ecosystem function to maintain biodiversity over the long term and serve as benchmarks against which we can measure biodiversity change.

This is important, but we must also recognize that conservation and sustainable use planning must be a priority on the working and altered landscapes. Biodiversity components and processes cannot be protected through a network of protected areas alone. Rather we must plan and carry out conservation and sustainable use planning activities that avoid and mitigate impacts of our activities on all landscapes.

## Genetic diversity

Genes are components, or parts, of the DNA molecule that contain and propagate biological diversity. For hundreds of years people have bred animals and plants to meet their own needs especially in agriculture and forestry. As well, researchers are currently looking at species as a possible source for drugs and medicines.

For example, an evergreen shrub called Canada yew found in Nova Scotia contains a chemical compound used in the treatment of cancers (Gunawardana et al, 1992). New molecular technologies including genetic engineering are further extending the possibilities for the development and use of products from plants and animals.

The use of molecular genetics also helps us understand the patterns of biological diversity in species and ecosystems. For example, studies of the genetics of masked shrews, Blandings turtles, and two wildflowers (Plymouth gentian and rockrose) have all shown that plants and animals have evolved quickly in Nova Scotia since the last ice age around 12,000 years ago, and that they contain unique genetic components.

The use of genetics in conservation and sustainable use in Nova Scotia is growing and has made significant contributions in the management and planning for species at risk and other components of biodiversity. Both the Convention on Biological Diversity and the Canadian Biodiversity Strategy recognize genetic diversity as an essential component of biodiversity (Laikre et al, 2009). Genetic diversity contributes to the health of a species and its individual members as well as providing the capacity to adapt to changing environments.

Several risks to genetic diversity are emerging and these are discussed in Appendix A.

## 3.0 A HOME FOR BIODIVERSITY: GOVERNANCE, LEADERSHIP, AND LEGISLATION

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### Background

Biodiversity is the foundation upon which financial, natural, human, and social capital are built. It is also the umbrella under which social, economic, and environmental prosperity develops. There is no department in the Government of Nova Scotia that does not affect, and is not affected by, the province's biodiversity and the benefits that Nova Scotians derive from it. Consequently the conservation and sustainable use of biodiversity necessarily forms a significant consideration when government decisions are made.

### Objective

Biodiversity will have a home in the Government of Nova Scotia, providing leadership, accountability, and coordination to ensure conservation and management of biodiversity occurs across all of the province's landscapes and waterscapes. All decisions with respect to the conservation and sustainable use of biodiversity will be made based on the best available and most up-to-date science and other knowledge.

### Discussion

#### 3.1 Governance and legislation

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Issues related to the conservation and sustainable use of biodiversity cross divisional boundaries within the Department of Natural Resources, departmental boundaries within the Government of Nova Scotia, and jurisdictional boundaries with other levels of government. Despite this, there is no lead authority or biodiversity legislation to champion biodiversity issues in Nova Scotia.

#### 3.2 Municipal role in the conservation and sustainable use of biodiversity

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With only 25 per cent of Nova Scotia's land base in public ownership, we are almost unique in Canada in the Crown having control over so little of our land base. For example: 60 per cent of Alberta, 94 per cent of British Columbia, 95 per cent of Newfoundland and Labrador, and 89 per cent of Canada overall are Crown lands. Only Prince Edward Island has a lower percentage of its land base under Crown control. Some activities that affect biodiversity on privately owned lands in Nova Scotia are influenced by individual municipal governments.

#### 3.3 Science and informed decision making

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Factors affecting Nova Scotia's biodiversity are influenced by a changing natural, economic, and social environment. Many threats such as climate change, the long-range transport of air pollutants, and a global economy, are outside of the direct control of the Government of Nova Scotia. Other threats, such as invasive alien species, are regulated by various government jurisdictions. However, all of these threats contribute to the context within which our government makes decisions.

Factors affecting these decisions are becoming more complex. The Government of Nova Scotia should develop a formal structure to draw on the knowledge of the scientific community to provide timely, up-to-date scientific advice on issues affecting biodiversity. This advice should come from two sources: government's internal scientific community, who are aware of the political environment within which scientific information is employed; and the external scientific community, which can provide an objective assessment of the current state of scientific understanding without regard to political considerations. This advice is not intended to remove social, economic, or political considerations from the government's decision-making process - only to ensure that the science considered is current and objectively assessed prior to socio-political considerations and consultation mechanisms.

## Recommendations

- Develop, adopt, and implement a biodiversity act. The act should:
  - designate the Department of Natural Resources as the lead department and the departments of Agriculture, Environment, Fisheries and Aquaculture, and Energy as key departments. Departmental roles and responsibilities need to be formalized.
  - ensure that high-level direction and leadership rest with Cabinet and a high-level interdepartmental committee. The Deputy Ministers Forum on Sustainable Competitiveness is a good model for both the level, and the operation of this committee.
  - develop a suite of regulatory and stewardship tools that apply across land type, land use, taxa, and government departments.
  - use a well-balanced combination of economic and social incentives, education, and regulation to define the requirement for a public biennial report on the state of biodiversity in Nova Scotia and of government performance with respect to the conservation and sustainable use of biodiversity.
  - contain a commitment to the co-ordinated inventorying and monitoring necessary for assessing the state of biodiversity.
  - contain mechanisms for dealing with conflicts and inconsistencies related to the management of biodiversity between federal, provincial, and municipal governments.
  - commit to develop and implement legislation and other tools to effectively manage invasive alien species and emerging issues.
- Review and revise legislation including, but not limited to, the Wildlife Act, the Forests Act, the Parks Act, the Environment Act, the Minerals Act, and the Crown Lands Act to reflect a current understanding of biodiversity.
- Develop and implement a Statement(s) of Provincial Interest under the Municipal Government Act to ensure that the conservation and management of biodiversity is a consideration in land use planning throughout Nova Scotia.
- Support the development of municipal plans relevant to biodiversity issues.
- Work with municipal and federal governments, other provincial departments, First Nations, conservation groups, business and industry, non-governmental organizations, educational and research institutions, and other stakeholder groups to develop strategies, action plans, and practices to address: invasive alien species, climate change, habitat protection, marine protected areas, and other priority issues.
- Ensure all regulations, policies, and guidelines respect biodiversity and give specific attention to their effects on the abiotic (non-living) components of the system.
- Establish a virtual science institute that will enable the provincial government's science community to work together on biodiversity and natural resource issues that cross divisional boundaries, to share information, to establish and maintain relationships with the external science community, and to advise the Minister of Natural Resources. This concept could be expanded across government departments.
- Establish an external science advisory body that will provide advice to the minister based on the most up-to-date scientific understanding of issues affecting biodiversity. This committee might include members from industry and the Nova Scotia population at large but, as a science advisory body, should remain specifically focused on current science.
- Support the development of a biodiversity institute that would bring together scientists, industry, government, and non-governmental organizations to address biodiversity issues.

## 4.0 BIODIVERSITY KNOWLEDGE

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### Background

Comprehensive and reliable biological inventories and monitoring programs are fundamental requirements for the conservation of biodiversity and the sustainable use of biological resources. There is general consensus among resource managers and biologists in Nova Scotia that there is need for improved and periodically updated inventories of species, ecological communities, and ecosystems throughout the province.

There are very few systematic, province-wide inventorying and monitoring programs for biodiversity, and no central or networked database exists to house all relevant natural resources information.

### Objective

Adequate collection, storage, and management of spatially referenced biodiversity data for genes, species, habitats, and ecosystems will take place. Data will be shared widely to support informed decision making for the conservation and sustainable use of biodiversity.

### Discussion

#### 4.1 Inventorying and monitoring

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The goals of inventorying and monitoring biodiversity are at least threefold: 1) to gather and integrate information about species, ecosystems, and genes in order to understand the current state of biodiversity and to be able to monitor changes through time, 2) to share and communicate the information with all stewards and regulators especially the public, and 3) to use and share the information to improve and guide conservation and resource management planning, policies, and decisions.

Although data exist for numerous taxa in a variety of formats from past surveys and studies, collection efforts are often biased based on study goals, taxonomic expertise, and the ease of collection. For example, we have substantial knowledge of the distribution of common plants in Nova Scotia, but we know very little about cryptic

insects, mosses, lichens, microbes, or marine organisms that live in the sediments. Even for plants, much of the data is old and many areas of the province are not adequately surveyed.

We need to organize, collate, and synthesize the fragments of biological information that are dispersed among many different organizations, individuals, and academic publications. Existing collections and databases (e.g. Nova Scotia Museum of Natural History, Atlantic Reference Collection, university collections, and Atlantic Canada Conservation Data Centre) could be assembled and “mined” for historical, distributional information to help establish priorities for future co-ordinated inventory efforts.

Biological surveys traditionally focus on a few species for short periods of time in localized areas. At the species level, especially for harvested species, many resource agencies have well-developed inventories. Few inventory and monitoring programs focus on surveying ecological communities or ecosystems at the landscape level. Landscape/waterscape level inventories are necessary to support the development of land use and resource management policies, plans, and decisions.

For certain taxa and habitats in Nova Scotia (e.g. birds, reptiles and amphibians, harvested animals, and significant habitats), digital inventory maps, and monitoring schemes have been partially developed. However, more comprehensive inventories are essential for all taxa and habitats to improve our ability to conserve and sustainably manage our natural resources into the future. To determine the true economic value of Nova Scotia’s ecosystem goods and services we must have thorough inventories of ecosystems, communities, species, genes, and ecological processes. The public sharing of these results will help Nova Scotians understand the real value of biodiversity.

#### 4.2 Information management

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Biodiversity information management initiatives, including conservation data centres, provide valuable resources that support a wide range of social, economic, and ecological decisions. Many agencies and government departments work in conjunction with data centres that deal with data management (such as the Atlantic Canada Conservation Data Center, College of Geographic Science, and NatureServe) that operate in accordance with local, national, and internationally recognized standards. A Nova



Scotia biodiversity information management system should be linked to local, national, and global systems, to improve the organization, exchange, correlation, and availability of data on biodiversity.

Information is defined to broadly include: the data collected by scientists; secondary products such as assessments, reports, journal articles, and websites; and tertiary products that translate scientific findings into policy objectives and funding priorities. An effective provincial network must address information collection and dissemination and how these are linked.

In order to be useful, a biodiversity information system for the province must include the development of a comprehensive, empirically sound database on the species, habitats, communities, and ecosystems found in the province. In addition to biological information, the database must be able to be linked with layers of physical and anthropogenic information required for sustainable resource management, including such things as roads, infrastructure, land use, acid precipitation, waterways, soil nutrients, and many others. The database should be spatially referenced and multi-layered, to facilitate integrated resource management.

Improved access to distribution maps and associated information enables everyone from students to research scientists, and from amateur naturalists to resource managers, to place a species in a geographic, taxonomic, and ecological context, and to gain an impression of the species' general status within that context. Furthermore, the biodiversity information system will contribute to risk management of specific threats to biodiversity including climate change, the spread of invasive alien species, crop disease outbreaks, and population dynamics of forest pests, through the development of predictive scenarios.

An information system will be important in contributing to our understanding of biodiversity science and in communicating this to society and resource managers. Engaging citizens in the conservation of biodiversity and the sustainable management of resources necessitates understanding how their private land management practices fit into the bigger picture. Citizens will be better stewards when they are aware of biodiversity on their property.

Using shared data, highly developed remote sensing and geographic information systems, and the expertise present within institutions such as the Nova Scotia Community Colleges, the Department of Natural Resources, and Maritime universities offers the potential for Nova Scotia to be a national and global leader in the field of integrated resource management.

## Recommendations

- Create a Nova Scotia biodiversity information management system comprised of experts, data, and a management system that will:
  - manage data storage, organize and disseminate biological, spatial, physical, and anthropogenic information for the Province of Nova Scotia.
  - conduct a gap analysis of specimen collections, and printed and digital databases.
  - compile, maintain, and share an up-to-date directory of individuals and organizations collecting data.
  - facilitate collaboration and support experts (universities, NGOs, First Nations, communities, and government agencies).
  - use local, national, and global standards.
  - actively share data.
  - make use of geographic information systems and remote-sensing technologies.
- Integrate species at risk and other wildlife species into ecosystem based management and the development of a broader approach to biodiversity.
- Continue to develop and apply regionally integrated landscape/waterscape level classification systems for terrestrial, freshwater, and coastal areas.
- Increase taxonomic expertise (i.e. scientists with the ability to identify certain groups of species) in the province.
- Support landscape/waterscape-level and cross-sectoral planning to integrate economic, social, and environmental conservation objectives.
- Support capacity of universities, museums, herbariums, and other institutions to collect, store, and evaluate living and preserved specimens, and to disseminate resulting data and information effectively.



## 5.0 BIODIVERSITY ISSUES AND MANAGEMENT

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### Background

At a strategic level, this section, and discussions in the appendices, address some of the threats and issues affecting biodiversity in Nova Scotia. A further list of issues is provided in Section 8.0.

Biodiversity is a component of a constantly changing environment, so any approach to managing biodiversity must be adaptive in the face of this change. Ideally, through science and planning, we can anticipate much of this change and be proactive in adapting management. As new issues emerge, the will and capacity must exist to respond.

### Objective

All levels of government will work together to manage and address threats to biodiversity in order to ensure that all species, ecosystems, and ecosystem processes will be maintained in Nova Scotia, and none will be put at risk due to human activities or lack of government action.

### Discussion

#### 5.1 Climate Change

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Climate change is a very serious threat to biodiversity. In Nova Scotia, climate change will cause changes to ecological systems, negatively impact biodiversity, and have important environmental and economic consequences. Detecting, monitoring, and understanding the significance of these changes is necessary to support adaptive management and impact mitigation (Stern 2006, Drysdale et al, 2008, Paterson et al, 2008).

The rate of climate change and subsequent impacts will depend on the amount of atmospheric pollutants, greenhouse gas input by humans, and the nature of ecosystems and biodiversity being affected. While climate change modeling allows scientists to speculate on change rates and certain effects, it remains essential to detect and monitor real changes to validate projections and develop adaptive responses.

Climate change falls under the mandate of a range of government agencies, institutions, and the private sector. A co-ordinated approach for research and management of these issues is required.

Predicted impacts of climate change in Nova Scotia include sea-level rise around the coast, changing coastal processes, increased inter-coastal erosion and salt-water intrusion (Shaw et al, 1998), increased summer and winter air temperatures (Scott and Suffling, 2000), and increased rainfall in the spring and fall with more fog events near coastal waters. Climate change could increase storm frequency, forest fire frequency and intensity, and alter insect pest distribution. Specific predictions will change in response to improved data and modeling. Currently there is little known about the specific impacts of climate change on biodiversity in Nova Scotia.

#### 5.2 Pollution and Waste

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Pollution is the contamination of ecosystems with elements, compounds, or materials that disrupt ecosystem functions. It affects all Nova Scotians by the degradation of air, water, and land, and it is an increasing problem for the conservation of biodiversity in Nova Scotia. All Nova Scotians have a role to play in reducing pollution and waste, and using energy efficiently.

The main sources of air pollution from within Nova Scotia come from the burning of fossil fuels for electricity and transportation, as well as residential wood burning for heat. Nova Scotia is also affected by the long-range transportation of air pollutants, especially those from the industrial areas of the United States and Canada that cause acid precipitation.

The main sources of water pollution stem from: the release of waste products and contaminants into surface runoff and into river drainage systems, leaching into groundwater, wastewater discharges, nutrient overloading, and littering. A number of watercourses and coastlines in Nova Scotia suffer from increasing silt loads, nutrient levels, and heavy metal and chemical pollution. Pollution of groundwater has adverse effects on ecosystems in both urban and rural environments. The conversion and degradation of forests, wetlands, grasslands, and riparian zones to other land uses impacts biodiversity and also causes an increase in the rate wastes move into the natural environment.

The use of some agricultural, industrial, and urban chemicals continues to cause problems for wildlife. Sewage discharge into lakes and the sea has localized impacts on biodiversity, but can have broader effects as they accumulate over time and spread over larger areas. Nova Scotia Environment is taking the lead in developing a comprehensive provincial water resources management strategy, which aims to address some of the problems of pollution control.

Nova Scotians have become known worldwide as leaders in the reduction of post-consumer waste through recycling and composting. Through the Environment Act and the Environmental Goals and Sustainable Prosperity Act (EGSPA), the Nova Scotia Government is committed to increasingly stringent goals in waste reduction, which will maintain our world leadership in this area.

### 5.3 Invasive Alien Species

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An alien species is a plant or animal that has been introduced to an area outside of its known natural range. It is considered invasive if its introduction and spread causes harm to the environment, economy, or society. Invasive alien species may affect biodiversity through species displacement (competition), predation, disease, parasitism, hybridization (interbreeding with native species), or habitat alteration.

Nova Scotia is especially susceptible to alien invasives from global shipping routes and recreational boats. We have recently experienced accidental and intentional introductions of several invasives into and throughout the province including: spinycheek crayfish, smallmouth bass, brown spruce longhorn beetle, European gypsy moths, and European fire ants. Invasives have had significant effects on all landscapes and waterscapes in the province.

Nova Scotians have suffered economic losses due to the costs of treatment or eradication of invasive alien species on land (e.g. Japanese knotweed, glossy buckthorn, and garlic mustard) and in water (e.g. European green crabs, MSX oyster parasites, and sea vase tunicates). Many of these invasive alien species have resulted in the decline of native species, and the transformation of our local ecosystems.

A National Invasive Species Strategy (2004) has been endorsed but efforts to address the problem in the province have been very limited. While several provincial

departments are involved in initiatives to help deal with certain harmful species, there currently is almost no legislation or policy on invasive alien species in Nova Scotia, nor is there a provincial lead or capacity to coordinate efforts for preventing the introduction and spread of harmful alien invaders.

### 5.4 Land Use

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Much of Nova Scotia's economic and social capital is affected by, and dependant on, how we use our land. While most would recognize forestry, parks, and protected areas as land use issues that affect biodiversity, it is important to recognize that all of our land use decisions impact the conservation and sustainable use of biodiversity. This includes urban development, agriculture, cottage development, road network development, and mineral extraction.

We have allowed the development of a mosaic of land use regulations and guidelines that are not universally applied within Nova Scotia. For example, riparian zone buffers, which provide multiple benefits to forest and aquatic biodiversity, are required of forestry operations but are not required of agricultural or urban development. Regulations and management practices benefiting the conservation and sustainable use of biodiversity should be applied regardless of how the land is used.

Equally important is the realization that, while biodiversity by definition deals with the biotic (living) components of a system, it is also dependent on the abiotic (non-living) components of a system. Any use of a system that degrades its abiotic elements affects biodiversity. Healthy ecosystem function is dependent on the flow of energy through the system and the cycling of nutrients within the system.

We can sustainably use both the energy and the nutrients in a system provided that we do not degrade the non-living components to the point that they no longer support the biodiversity inherent to the system. We see the results of this in some agricultural practices where nutrients have been removed from the system and the system no longer retains sufficient nutrients to support crop growth. Consequently much of modern industrial agriculture is dependent on the artificial application of nutrients through the use of chemical fertilizers, while in the past nutrients would have been returned to the system through crop

rotation, with fallow seasons included in the rotation, and the use of compost and manure.

We risk having forest ecosystems become similarly dependent on the artificial input of nutrients if we allow harvesting practices that remove nutrients from the system at an unsustainable rate. It is important that we get this right as the abiotic degradation of forest ecosystems will occur over multiple harvest cycles and the full impact of decisions made today may not be recognized until remediation is expensive or impossible.

Appendix B provides a more in-depth discussion and recommendations associated with maintenance of primary productivity and biodiversity on working forest landscapes. Similarly Appendix C discusses biomass fuels, forestry, agriculture, and biodiversity.

## 5.5 Freshwater Ecosystems

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Southwestern and eastern Nova Scotia waters tend to be shallow, warm, acidic, and nutrient poor. These characteristics are primarily determined by the nature of soils, geology, and the levels of acid precipitation emanating from pollution sources in North America.

While acid deposited from long-range transport of air pollution has been decreasing due to regulatory controls, there continues to be significantly more acid in precipitation when compared to clean rain (Tordon, 2010). Aquatic systems in other parts of the province tend to be less acid due to geologic conditions, but may still be vulnerable.

Aquatic systems in Nova Scotia will be impacted by climate change. A number of aquatic species in Nova Scotia are near the limits of their northern range (e.g., coastal plain flora) or southern range (e.g., brook trout) and thus more vulnerable to the impacts of climate change. Climate change may also impact seasonal temperature stratification on lakes in southwestern Nova Scotia. Some lakes that stratified in the past, with a cold-water layer forming below warmer surface waters, are now remaining mixed to the detriment of some cool-water aquatic species such as trout.

Various land uses including agriculture, urban development, and forestry with insufficient shore line buffering and/or sustainable soil management can increase acidity, pollution, nutrient overload, siltation, and water

temperature in associated aquatic ecosystems.

These changes can result in increased toxic chemicals, decreased oxygen availability, and decreased water clarity.

Physical barriers to movement deny access to critical habitat such as spring-fed reproduction sites and cold-water refuges. These barriers include poorly installed culverts, dams without fish passage, and portions of streams where vegetation cover has been removed allowing significant increase in water temperatures and siltation.

Increasing shoreline development on lakes, rivers, and the edges of wetlands also has the potential to damage or destroy freshwater habitats and biodiversity. Land owners and developers are often not aware of the presence of sensitive and rare species using these habitats and the impacts of human activities on these ecosystems.

## 5.6 Coastal Zones

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The full extent of biodiversity and ecological goods and services associated with coastal zones in Nova Scotia is poorly understood and undervalued, and yet coastal zones are experiencing increasing rates of habitat degradation from human development, intensive fishing, invasive alien species, climate change, and pollutants.

Nova Scotia has 13,300 kilometres of coastline. Approximately 70 per cent of Nova Scotia's population lives on the coast. Within an area two kilometres from the coastline, 80 per cent of the area is undeveloped with the remaining areas used by urban development (8 per cent), agriculture (7 per cent), infrastructure and industrial uses (3 per cent) and managed forest land (2 per cent). Only 14 per cent of coastal lands are publicly owned (2009 State of Nova Scotia's Coast).

The province delegates land use planning to municipalities through the Municipal Government Act. By 2009, only 45 per cent of the province's land had comprehensive municipal planning strategies and associated bylaws in place. Without municipal planning for almost half of the province, there can be no co-ordinated biodiversity protection.

There is a significant requirement to complete coastal zone planning, integrating the roles and responsibilities of all levels of government. This must be done with the

understanding and support of coastal communities. Similarly there is a need to measure and understand the dynamics of human use of coastal environments to facilitate planning.

At the land-sea interface, a better understanding is required of the dynamics of sea-level rise and associated changes to coastal ecosystems. There is a need to complete high resolution habitat mapping and field validation of biodiversity components and geology across the province.

In a number of areas it is necessary to restore impacted habitat and water quality by eliminating sewage input, removing obstructions to migratory fish movement, mitigating alien invasive species occurrence when feasible, and managing waste from aquaculture operations and fish processing plants.

## 5.7 Impact of Human Population and Urbanization on Biodiversity

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When the Canadian Biodiversity Strategy was published in 1995, the global human population was estimated to be 5.6 billion. Fifteen years later, the global human population is close to 6.8 billion (United States Census Bureau). While Nova Scotia's population is not growing at an equivalent rate, we are sharing the planet's resources with a growing global population. The developed countries, including Canada, continue to have the highest rates of water and energy consumption and of waste generation. Nova Scotia is also affected by the distribution, or redistribution, of the global population through immigration.

Beyond immigration we face demographic changes that are reflected in an increasing urbanization of our population. This is not unique to Nova Scotia - increasing urbanization is happening in many nations as populations age, and available employment is increasingly centred in urban areas. The resultant increase in urban development affects the conservation and sustainable use of biodiversity in ways that are not always considered in planning and for which little policy or legislation exists. It is worthy of note that urbanization affects not only Halifax, but smaller urban centres such as Truro and Antigonish, and developing urban centres such as New Minas.

Poorly planned infrastructure development in both urban and rural Nova Scotia has the potential to cause significant ecological impact. As of 2009, 55 per cent of the

province's land did not have comprehensive municipal planning strategies including zoning and bylaws in place. Without adequate planning and regulation, valued biodiversity and ecosystem services associated with these environments will be degraded or lost.

Because of the limited productive land in our province, the agricultural sector is at significant risk from urban development. However, uncontrolled development of forest, freshwater, wetland, and coastal areas is also of concern.

It is notable that municipalities across the province are undertaking the development of integrated community sustainability plans. These plans may be useful tools to address the impacts of urbanization and human population growth on biodiversity.

## 5.8 Biodiversity and the Role of Protected Areas and Parks

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Protected areas in Nova Scotia, including national parks, provincial parks, provincial wilderness areas, wildlife management areas, and some municipal parks serve a crucial role for the protection of biodiversity (Dudley, 2008). They ensure that representative ecological areas are allowed to function naturally without harmful human influence. In addition to protecting biodiversity, parks and wilderness areas offer important opportunities for research, education, and recreation in the natural environment.

Understanding biodiversity and natural ecological processes in protected areas can help scientists and resource managers make better decisions on working landscapes where sustainable harvest is an important consideration. Educational interpretive programs in parks serve to inform the public about the significance of biodiversity in settings that are often spectacular and physically exhilarating. Protected areas offer the opportunity for Nova Scotians and visitors from afar to experience the spirituality of the wild landscape.

Currently the Government of Nova Scotia is striving to increase the percentage of protected areas from about 8 per cent to 12 per cent in accordance with EGSPA and accepted international targets. This is an important goal and must remain a very high priority for the protection of biodiversity. The Government of Nova Scotia and the Colin

Stewart Forest Forum among others are to be complimented for this progress thus far.

Protected areas are often defined by administrative boundaries based on land availability, adjacent land ownership, and the economic realities of working landscapes where resource extraction takes place. However the distribution and habitat of critical biodiversity components often extend well past the surveyed boundary lines defining a protected area.

There are still significant gaps in our understanding of the habitat requirements and genetic diversity of many species. The response and adaptation of species to climate change must be considered. The biodiversity characteristics of protected forests will change as they grow older. To ensure biodiversity is sustained on the broader landscape and in protected areas, informed co-operation among land trusts, non-governmental organizations, land owners, industry, Crown land, and protected area managers is essential. Progress in Nova Scotia associated with the development of ecological connectivity between working landscapes and protected areas has been positive, but much work remains.

## 5.9 Species at Risk and Rare Species

Human activities that threaten biodiversity have resulted in the extinction of many species and increased risk of extinction to many additional species. Currently in Nova Scotia there are over 60 species determined to be at risk (Mersey Tobeatic Research Institute, 2008).

Nova Scotia has a strong stewardship community as well as species-at-risk conservation legislation (Endangered Species Act). The province has been a leader in Canada in addressing this important aspect of biodiversity conservation. Despite progress on assessing species, recovery planning, and stewardship efforts for species at risk, Nova Scotia needs to enhance inventorying, planning, and management of species at risk if we are going to maintain and recover these species.

While the Endangered Species Act provides a good basis for species-at-risk recovery, experts in the province have expressed concern that capacity in support of the act needs to be increased. There have been delays in the listing of species, recovery plans have been overdue, identification of critical habitat has lagged, and success of recovery has been limited. Adequate staffing and financial

resources are required to provide for listing and recovery of species at risk.

There has been considerable time and money spent on species at risk by various levels of government, some industries, and non-governmental organizations in Nova Scotia, but the province needs to better demonstrate leadership and provide support. A more proactive approach to species at risk is required. It should build on and integrate ecosystem-based management efforts including integrated resource management and the General Status of Wildlife program.

### Recommendations

- Review and increase the levels of environmental monitoring of currently used pesticides and other hazardous chemicals including transboundary pollutants.
- Support the maintenance and restoration of coastal ecosystems, including salt marshes, migratory fish habitat, and coastal sediment dynamics.
- Review all land use activities (e.g. gravel pits, suburban development, road construction) that potentially impact biodiversity in Nova Scotia and take actions to avoid, mitigate, and compensate for significant impacts of these activities on biodiversity. This should assess and address cumulative impacts.
- Provide adequate staff and funding to lead and implement the conservation and sustainable use of biodiversity in Nova Scotia.
- Align enforcement activities with biodiversity priorities.
- Develop and implement mechanisms for the full-cost accounting, valuation, and monitoring of the province's ecosystem goods and services.
- Encourage the continued development of a best practices approach by forest and agricultural land users to improve protection of terrestrial and aquatic systems productivity.
- Develop incentives and remove impediments to conserving land and maintaining natural capital in recognition of the fact that taking privately owned land out of production to protect biodiversity may be in the public good but may represent a cost to the land owner.



## Recommendations *continued*

- Support and strengthen the existing General Status of Wildlife program and use this information widely in planning and decision making to help prevent species from becoming at risk.

# 6.0 EDUCATION, ENGAGEMENT, AND STEWARDSHIP

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## Background

The conservation and sustainable use of biodiversity in Nova Scotia will require the co-operative and co-ordinated efforts of government, industry, non-governmental organizations, and individual Nova Scotians. A citizenry engaged in the stewardship of natural resources will not only support the conservation of biodiversity on privately held lands, they will actively hold government and industry accountable for the stewardship of natural resources on public lands.

Clearly, more citizens must become engaged in the conservation and management of biodiversity. This will not happen without a more comprehensive understanding of biodiversity and the benefits provided by properly functioning natural systems.

## Objective

Nova Scotians will have an increased understanding of biodiversity to become better engaged in the conservation of biodiversity and realize the benefits of healthy natural systems.

## Discussion

### 6.1 Education

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While some Nova Scotians understand biodiversity to include the variety of plants and animals in Nova Scotia, few would identify genetic variation or ecological processes as parts of this diversity. It is also clear that many Nova Scotians do not understand the substantial benefits we all receive in terms of goods and services from these ecological processes.

Biodiversity education needs to encompass all age groups and should take advantage of multiple approaches. These approaches include: formal education under the Department of Education (primary to grade 12 ); informal education under other provincial government departments



(such as the Natural Resources Education Centre, the Shubenacadie Wildlife Park, and the Nova Scotia Museum); and informal education provided by many non-governmental organizations and community groups.

## 6.2 Engagement and Stewardship

Stewardship can be thought of in several ways. Nova Scotians practice stewardship when they: 1) take steps to learn more about biodiversity and the natural environment, 2) exercise concern over the use of our natural resources, 3) take pride in the sustainable use of land and resources, and 4) join organizations focused on the responsible use of natural resources, or volunteer for programs and activities that lead to the conservation and sustainable use of biodiversity.

Engaging Nova Scotians in hands-on stewardship opportunities allows them to contribute to the conservation and sustainable use of biodiversity, and to make a stronger connection with the natural environment that facilitates a better understanding of the benefits derived from biodiversity. This already happens in many ways in Nova Scotia: breeding bird surveys, the Christmas bird count, and the Herpetofaunal Atlas project are all dependent on volunteer participation. In addition, volunteers have played a large part in the conservation and recovery of species at risk. For example, the nest monitoring and protection program for Blanding's turtle is conducted by trained volunteers. Trained volunteers can play a significant role in the inventorying and monitoring of biodiversity in Nova Scotia and, properly guided, can help provide a link between the stewardship of private and public lands.

While the use of volunteer stewards can be a cost-effective way of conserving species, systems, and processes, it must be recognized that it is not free. There is a need for training, coordination, material support, and recognition of their contribution. The non-governmental organizations and communities that provide these opportunities need support in terms of funding, promotion, and better relationships with industry and government.

## Recommendations

- Develop curriculum (Department of Education) including biodiversity across all grades from primary to grade 12. In the early grades learning should be experiential and age appropriate; later grades should deal with technical aspects. Subject matter experts within and external to provincial departments should be consulted in determining learning outcomes.
- Provide opportunities for all Nova Scotians to learn more about and become engaged in stewardship of biodiversity. Initiatives should include overlooked aspects of biodiversity including but not limited to: species at risk, invasive alien species, estuarine issues, and shoreline ecosystems.
- Include biodiversity specific programs and information in the existing Department of Natural Resources education program.
- Develop outreach programs and means for disseminating biodiversity information to the general public.
- Enhance biodiversity education and stewardship in collaboration with non-governmental organizations and interested community groups to engage all Nova Scotians and provide support to these organizations. In some cases support may need to be financial but can take many forms such as: assistance with advertising programs, providing educational material and support, and encouraging the effective interaction between non-governmental organizations' activities and government goals for the conservation and sustainable use of biodiversity.

## 7.0 EMERGING BIODIVERSITY ISSUES

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### Background

Important issues affecting biodiversity will continue to be identified as knowledge and priorities for biodiversity evolve. These emerging issues must be addressed as the province moves forward with a biodiversity strategy and the conservation of biodiversity and the sustainable use of biological resources.

There currently are no guidelines, policies, or legislation in Nova Scotia that address the risks and opportunities for access and benefits sharing, including bioprospecting, or for genetically modified organisms.

### Objective

The Province of Nova Scotia will take adequate and timely action to identify and address emerging biodiversity issues in Nova Scotia.

### Discussion

#### 7.1 Economic Valuation of Ecosystem Goods and Services: Valuing Natural Capital

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Recognizing that our current society revolves around economics, there are mainstream regional and global movements to economically value biodiversity and ecosystem services, also referred to as natural capital. In 2010, two major initiatives: The TEEB Report (The Economics of Ecosystems and Biodiversity) and The Green Economy Initiative will be completed and presented by global leaders (Naidoo and Ricketts, 2006, Olewiler, 2004, Balmford et al, 2002, Greenview, 2010).

“Losses in the natural world have direct economic repercussions that we systematically underestimate. Making the value of our natural capital visible to economies and society creates an evidence base to pave the way for more targeted and cost-effective solutions. We are facing a

biodiversity crisis even though we are major beneficiaries of nature’s multiple and complex values.”

TEEB Report for Policy Makers 2009

Efficient management of our natural capital resources requires knowing how much we have. In Nova Scotia, we have barely begun the process of assessing the true biological, sociological, and economic values of biodiversity and ecosystem services. This assessment is key to meeting our overall EGSPA goal of being a world leader in sustainability by 2020.

Greening the economy refers to the process of reconfiguring businesses and infrastructure to deliver better returns on natural, human, and economic capital investments, while at the same time reducing greenhouse gas emissions, extracting and using less natural resources, creating less waste and reducing social disparities.

UNEP Green Economy Initiative 2009

#### 7.2 Access and Benefits Sharing

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One of the overall goals of the International Convention on Biodiversity is the fair and equitable sharing of the benefits that result from the use of genetic resources. Access and benefits sharing is centred on the principles that it is in the public good to provide access to genetic resources but that this access must be regulated, and benefits arising from the use of biological resources must be shared equitably. Currently there is some collaborative work by federal and provincial agencies on access and benefits sharing but Nova Scotia has not had the capacity to participate adequately in this work.

Bioprospecting involves sampling biodiversity for previously unknown compounds that can be commercialized. New molecular technologies including genetic engineering are extending the possibilities for the development and use of products from living organisms. Although currently there is very little bioprospecting in Nova Scotia, there is much potential.

### 7.3. Genetically Modified Organisms and Regulating the Use of Genetic Resources

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A genetically modified organism is created by transferring genes from one species to another to provide functions not originally occurring in the natural organism. According to the Canadian Biodiversity Strategy, genetically modified organisms offer the potential for economic and social benefits as well as a means to address existing problems affecting biodiversity (such as pest and disease resistance). However, these organisms have the potential to adversely affect species and ecosystems.

#### Recommendations

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- Conduct research, examine options, and develop tools to address the biodiversity issues, risks, and opportunities for emerging issues, including but not limited to access and benefits sharing, bioprospecting, and the use of genetically modified organisms.

## 8.0 THE SCOPE OF THIS BIODIVERSITY REPORT

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Maintaining a healthy biological diversity is fundamental to the development of our natural, human, social, and economic capital. Healthy biodiversity affects, and is affected by, almost all of our activities as individuals and as a society. As a consequence, a report on biodiversity must cover a tremendous breadth and depth of material. This report has dealt with themes, sometimes at the expense of fine detail. We have included this section to identify for the Steering Panel and the Government of Nova Scotia issues that were not captured in detail but are important issues in the conservation and sustainable use of resources.

#### Some issues not addressed in depth in this report:

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- Transboundary threats to biodiversity
- Nova Scotia participation in regional, national, and international biodiversity efforts
- Impacts and management of human development
- Agriculture, including livestock and crop diversity
- The impacts and opportunities of tourism and biodiversity
- Understanding and managing wildlife diseases
- Road construction and road network planning
- Human-wildlife interactions
- Marine protected areas
- Mining and biodiversity
- Aquatic ecosystems: riverine, wetland, estuarine, and marine ecosystems
- Ecohydrology or hydroecology (the interaction between water systems and ecology)

We consulted with a large number of young Nova Scotians. Individual concerns, while not specifically identified to youth, are reflected in this report. Two key themes emerged: 1) young Nova Scotians said that there was no voice for them in environmental issues, and 2) if they were more actively engaged through media that they use, there would be significant participation of youth in the conservation and sustainable use of natural resources. It is imperative that youth be engaged early on as they will be the biodiversity champions into the future.

## 9.0 THE MI'KMAQ AND BIODIVERSITY

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The Mi'kmaq for a long time have played a key role in the conservation and sustainable use of biodiversity in Nova Scotia. The Biodiversity Panel was not able to formally meet, consult, or benefit from the expertise and unique perspective of Mi'kmaq during this phase of the Natural Resources Strategy 2010 process. The panel did benefit from some informal discussions with individuals working on biodiversity, wildlife, and resource use in the province.

The Convention on Biological Diversity reinforces the need to respect, preserve and maintain the knowledge, innovations and practices of indigenous communities that relate to the conservation and sustainable use of biodiversity.

Canadian Biodiversity Strategy

Over time, the Mi'kmaq Rights Initiative will provide the framework for consultation and involvement of Mi'kmaq in Nova Scotia in wildlife and biodiversity issues. As well, there are considerable local programs and projects led by Mi'kmaq communities that support understanding, stewardship, and protection of biodiversity.

### Recommendation

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- Work with Mi'kmaq in the development and implementation of a provincial strategy for biodiversity.

“Humans have a minor role in this world. Now, for this moment, we are part of its thread of life. Step lightly and carefully. There is much to absorb. Ancestors needed to learn so they could survive. So do we.”

Awakening: Living with today's forests

## 10.0 LIST OF RECOMMENDATIONS

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1. Develop, adopt, and implement a biodiversity act. The act should:
  - a. designate the Department of Natural Resources as the lead department and the departments of Agriculture, Environment, Fisheries and Aquaculture, and Energy as key departments. Departmental roles and responsibilities need to be formalized.
  - b. ensure that high-level direction and leadership rest with Cabinet and a high-level interdepartmental committee. The Deputy Ministers Forum on Sustainable Competitiveness is a good model for both the level, and the operation of this committee.
  - c. develop a suite of regulatory and stewardship tools that apply across land type, land use, taxa, and government departments.
  - d. use a well-balanced combination of economic and social incentives, education, and regulation to define the requirement for a public biennial report on the state of biodiversity in Nova Scotia and of government performance with respect to the conservation and sustainable use of biodiversity.
  - e. contain a commitment to the co-ordinated inventorying and monitoring necessary for assessing the state of biodiversity.
  - f. contain mechanisms for dealing with conflicts and inconsistencies related to the management of biodiversity between federal, provincial, and municipal governments.
  - g. commit to develop and implement legislation and other tools to effectively manage invasive alien species and emerging issues.
2. Review and revise legislation including, but not limited to, the Wildlife Act, the Forests Act, the Parks Act, the Environment Act, the Minerals Act, and the Crown Lands Act to reflect a current understanding of biodiversity.
3. Develop and implement a Statement(s) of Provincial Interest under the Municipal Government Act to ensure that the conservation and management of biodiversity is a consideration in land use planning throughout Nova Scotia.
4. Support the development of municipal plans relevant to biodiversity issues.
5. Work with municipal and federal governments, other provincial departments, First Nations, conservation groups, business and industry, non-governmental organizations, educational and research institutions, and other stakeholder groups to develop strategies, action plans, and practices to address: invasive alien species, climate change, habitat protection, marine protected areas and other priority issues.
6. Ensure all regulations, policies, and guidelines respect biodiversity and give specific attention to their effects on the abiotic (non-living) components of the system.
7. Establish a virtual science institute that will enable the provincial government's science community to work together on biodiversity and natural resource issues that cross divisional boundaries, to share information, to establish and maintain relationships with the external science community, and to advise the Minister of Natural Resources. This concept could be expanded across government departments.
8. Establish an external science advisory body that will provide advice to the minister based on the most up-to-date scientific understanding of issues affecting biodiversity. This committee might include members from industry and the Nova Scotia population at large but, as a science advisory body, should remain specifically focused on current science.
9. Support the development of a biodiversity institute that would bring together scientists, industry, government, non-governmental organizations to address biodiversity issues.
10. Create a Nova Scotia biodiversity information system comprised of experts, data, and a management system that will:
  - a. manage data storage, organize, and disseminate biological, spatial, physical, and anthropogenic information for the Province of Nova Scotia.
  - b. conduct a gap analysis of specimen collections and printed and digital databases.

- c. compile, maintain, and share an up-to-date directory of individuals and organizations collecting data.
  - d. facilitate collaboration and support experts (universities, NGOs, First Nations, communities, and government agencies).
  - e. use local, national, and global standards.
  - f. actively share data.
  - g. make use of geographic information systems and remote-sensing technologies.
11. Integrate species at risk and other wildlife species into ecosystem-based management and the development of a broader approach to biodiversity.
  12. Continue to develop and apply regionally integrated landscape/waterscape level classification systems for terrestrial, freshwater, and coastal areas.
  13. Increase taxonomic expertise (i.e. scientists with the ability to identify certain groups of species) in the province.
  14. Support landscape/waterscape-level and cross-sectoral planning to integrate economic, social, and environmental conservation objectives.
  15. Support capacity of universities, museums, herbariums, and other institutions to collect, store, and evaluate living and preserved specimens, and to disseminate resulting data and information effectively.
  16. Review and increase the levels of environmental monitoring of currently used pesticides and other hazardous chemicals including transboundary pollutants.
  17. Support the maintenance and restoration of coastal ecosystems including salt marshes, migratory fish habitat, and coastal sediment dynamics.
  18. Review all land use activities (e.g. gravel pits, suburban development, road construction) that potentially impact biodiversity in Nova Scotia and take actions to avoid, mitigate, and compensate for significant impacts of these activities on biodiversity. This should assess and address cumulative impacts.
  19. Provide adequate staff and funding to lead and implement the conservation and sustainable use of biodiversity in Nova Scotia.
  20. Align enforcement activities with biodiversity priorities.
  21. Develop and implement mechanisms for the full-cost accounting, valuation, and monitoring of the province's ecosystem goods and services.
  22. Encourage the continued development of a best practices approach by forest and agricultural land users to improve protection of terrestrial and aquatic systems productivity.
  23. Develop incentives and remove impediments to conserving land and maintaining natural capital in recognition of the fact that taking privately owned land out of production to protect biodiversity may be in the public good but may represent a cost to the land owner.
  24. Support and strengthen the existing General Status of Wildlife program and use this information widely in planning and decision making to help prevent species from becoming at risk.
  25. Develop curriculum (Department of Education) including biodiversity across all grades from primary to grade 12. In the early grades learning should be experiential and age appropriate; later grades should deal with technical aspects. Subject matter experts within and external to provincial departments should be consulted in determining learning outcomes.
  26. Provide opportunities for all Nova Scotians to learn more about and become engaged in stewardship of biodiversity. Initiatives should include overlooked aspects of biodiversity including but not limited to: species at risk, invasive alien species, estuarine issues, and shoreline ecosystems.
  27. Include biodiversity specific programs and information in the existing Department of Natural Resources education program.
  28. Develop outreach programs and means for disseminating biodiversity information to the general public.
  29. Enhance biodiversity education and stewardship in collaboration with non-governmental organizations and interested community groups to engage all Nova Scotians and provide support to these organizations. In some cases support may need to be financial but can take many forms such as: assistance with advertising



programs, providing educational material and support, and encouraging the effective interaction between non-governmental organizations' activities and government goals for the conservation and sustainable use of biodiversity.

30. Conduct research, examine options, and develop tools to address the biodiversity issues, risks, and opportunities for emerging issues, including but not limited to access and benefits sharing, bioprospecting, and the use of genetically modified organisms.
31. Work with Mi'kmaq in the development and implementation of a provincial strategy for biodiversity.

Detailed recommendations associated with "Sustaining primary productivity and biodiversity on working landscapes" and "Biomass fuels, forestry, agriculture, and biodiversity" are included in Appendices B and C, respectively.

## 11.0 GLOSSARY

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### **Access and benefits sharing**

This refers to genetic resources and bioprospecting under the United Nations Convention on Biological Diversity. It includes sustainable access to genetic resources and providing for the fair and equitable sharing of benefits arising from their use.

### **Adaptive management**

The implementation of corrective measures in systems on an ongoing basis, based on a process of continued monitoring. In the case of biodiversity, adaptive management begins with the monitoring of the impacts (environmental, social, and economic) on the ecosystems and populations resulting from the use of biological resources.

### **Bioactives**

Molecular components of food that possess biological activity in addition to their nutritional value.

### **Biodiversity**

Also referred to as biological diversity, it is the variety and interconnectedness of life, including all species of plants, animals, and other organisms, the genes they contain, and the ecosystems and ecological processes of which they are a part.

### **Biofuels**

Energy sources that are produced from plant materials (such as corn or grasses) and organic wastes (such as animal wastes).

### **Bioindicators**

Species used to monitor the health of the environment.

### **Bioprospecting**

The sampling of diverse organisms for genes, gene products, and other compounds that are of value to humans. These products and compounds can be developed and marketed by medical, pharmaceutical, agricultural, natural resource, and other sectors.

### **Ecological goods and services or ecosystem goods and services (or ecosystem goods and services)**

These refer to the benefits arising from the ecological functions of healthy ecosystems. Such benefits accrue to all living organisms, including animals and plants, rather than to humans alone. However, there is a growing recognition of the importance to society that ecological goods and services provide for health, social, cultural, and economic needs.

### **Ecological management**

The management of human activities so that ecosystems, their structure, function, composition, and the physical, chemical, and biological processes that shaped them, continue at appropriate time and geographic scales. Ecological management is sometimes called ecosystem management or an ecological approach to management.

### **Ecosystem**

A dynamic complex of plants, animals, and micro-organisms and their non-living environment interacting as a functional unit. The term ecosystem can describe small-scale units, such as a drop of water, as well as large-scale units, such as the biosphere.

### **Estuarine**

A partly closed body of water where one or more rivers joins the sea.

### **Genetically modified organisms**

Organisms whose genetic information has been altered by any technique including natural processes, mutagenesis (the formation or development of a mutation) or genetic engineering.

### **Integrated resource management (IRM)**

In Nova Scotia, this is a process that co-ordinates resource use so that the long-term sustainable benefits are optimized and conflicts among users are minimized. IRM brings together all resource groups rather than each working in isolation to balance the economic, environmental, and social requirements of society. IRM includes planning for minerals, forests, recreation, wilderness, energy, wildlife, and parks.

### **Invasive alien species**

A plant or animal occurring in an area outside of its known natural range as a result of accidental or intentional introduction through human activities. An alien species is considered invasive if its introduction and spread causes harm to the environment, economy, and/or society.

### **Natural capital**

Raw materials such as water, air, plants, animals, land, and minerals contribute to the appeal of our communities and fuel our economy. This is one of the pillars of *Opportunities for Sustainable Prosperity 2006*, the economic growth strategy for Nova Scotia.

### **Primary productivity**

This refers to the amount of organic matter an ecosystem produces from solar energy within a given area during a given period of time.

### **Provincial statement of interest**

Under the Municipal Government Act, these are statements that recognize the importance of our land and water resources, and future growth of our communities. They provide guiding principles to help provincial government departments, municipalities, and individuals in making decisions regarding land use. They are supportive of the principles of sustainable development.

### **Sustainability**

This refers to the ability to sustain something, for example: a natural resource, or a society where its members and economy are able to meet their needs and express their greatest potential in the present, while preserving biodiversity and natural ecosystems and planning, and acting for the ability to maintain these ideals in the long term.

### **Taxa (plural) taxon (singular)**

A taxonomic group is a group of related animals or plants. For example: birds, dragonflies, orchids, sharks.

## 12.0 APPENDICES

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### Appendix A: Risks to genetic diversity

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There are a number of current threats to genetic diversity. Some of these, such as habitat fragmentation, are recognized as threats at other levels of biological diversity as well, while others, such as single- or reduced-species (monoculture) approaches to agriculture and forestry, may be less well recognized. Fragmentation of habitats results in smaller breeding groups leading to higher instances of inbreeding and a resultant loss of genetic diversity.

The effects of monoculture approaches to agriculture and forestry are compounded if the crop or stock is being selected for particular traits as this may lead to an overall reduction in genetic diversity within a species. The ability for any species to adapt to change is based, in large part, on the extent of their genetic diversity. As the environment changes so will its effect on individuals. If environmental change exceeds the available variation in individuals, the species will not be able to respond to this change and will go extinct.

The assessment of genetic diversity within a species is time consuming and may be costly, but the capacity exists and it should be undertaken whenever possible. Assessing genetic diversity and its distribution is already being done for many species at risk but needs to be extended to other species. There is general concern within the scientific community that insufficient progress is being made on the assessment and conservation of genetic diversity. (Laikre et al. 2009)

A complete assessment of the threats to genetic diversity and the approaches needed to address both our current understanding of genetic diversity in Nova Scotia and the threats to that diversity are beyond the scope of this report. This in no way relieves the Government of Nova Scotia of the responsibility to respond to these concerns, and consultation with experts in this field should be undertaken as soon as possible to establish a process under which this can be dealt with. This would fall logically within the purview of the recommended science advisory council.

### Appendix B: Sustaining primary productivity and biodiversity on working forest landscapes

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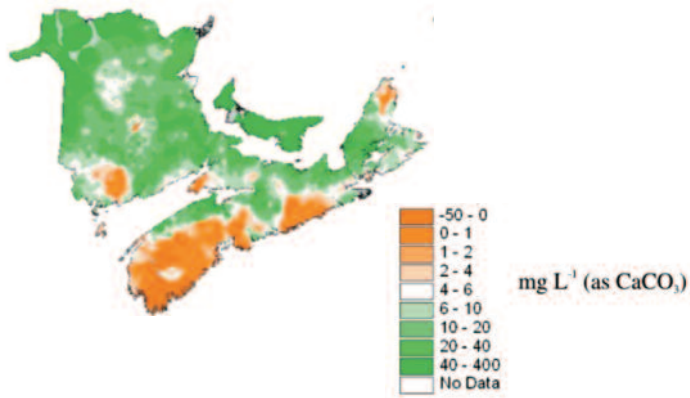
Inappropriate application of some forest-harvesting practices has the potential to deplete soil quality, reducing primary productivity (the ability of the soils to support living organisms) on vulnerable lands across the province. This could significantly impact biodiversity, forest growth rates, ecological resilience, and associated economic productivity on public and private lands. These impacts would extend to associated aquatic ecosystems.

#### **Vulnerability of Nova Scotia forest soils and biodiversity to nutrient depletion**

Forest biodiversity can be depleted when essential soil quality and quantity is compromised through nutrient depletion. Examples of forest ecosystem collapse caused by soil depletion exist across the globe.

Soils in eastern and southwestern Nova Scotia tend to be quite shallow and are the most acidic in Atlantic Canada. This acidic soil area is defined by regional granite and shale geology that has little buffering capacity. Soils from this parent material, and the water that drains through them, are vulnerable to further acidification, even under low-acid precipitation (Clair et al, 2008).

Soils associated in this sensitive zone are showing a loss of calcium, which must inevitably lead to impoverishment of plant communities (Clair et al, 2008). Most of Nova Scotia is still receiving critical loads of precipitation-born sulphates, exceeding the amount an ecosystem can take without some physical damage. Rain falling in southwestern Nova Scotia is still ten times more acidic than unpolluted precipitation based on Environment Canada data.



**Figure 1.** Map showing areas with low soil and aquatic system calcium values.

As soils in a given drainage basin are acidified, the water flowing through those soils becomes more acidic. Aquatic ecosystem acidification impacts biodiversity, including such factors as fish reproduction potential. Acidification also facilitates mobilization of toxic elements. For example, there is a positive relationship between aquatic systems acidity and the amount of mercury in fish tissue (Drysdale et al, 2005).

### Forest harvest practices and the concern about whole-tree harvest

Under theoretically ideal forest harvest conditions, nutrients removed from the site when tree trunks are harvested are slowly replaced through weathering of sub-soils and bedrock. Nutrients in remaining “slash” including tree branches, leaves, and root systems, also contribute significantly to the soil nutrient pool. Slash also contributes to the physical texture of the soil.

Intensive forest harvest has become more common in Nova Scotia. Both softwood and hardwood trunks (boles) are often removed. With the advent of portable chipping machines and growing global demand for biofuels, whole-tree harvest may increasingly be used to process complete trees including stumps, branches, and tops to obtain additional revenue for the land owner.

Forest ecologists have suggested that moderate increases in potential biomass yield, particularly through whole-tree harvest practices in Nova Scotia is obtained at the expense of much larger increases in removal of soil calcium (Freedman et al, 1985). Subsequent additional soil acidification can decrease tree regeneration rates. Conversely, forest soil specialists have suggested that conservation of nutrients in the foliage and slash could moderate site acidification (Mahendrappa et al, 1986).

There is potential for serious decreases in nutrient and moisture availability and increases in erosion when surface organic horizons are removed or redistributed as a consequence of tree stump removal. Forest floor soil horizons are an important source of nutrients for plants, soil organisms, and fungi, and also regulate moisture supply and temperature extremes near the soil surface (P. Neilly, Pers Con. 2010).

Removal of biomass can also negatively impact the quantity and quality of structures such as coarse woody debris that are so important for the maintenance and conservation of populations of both plant and animal biodiversity. It has been estimated that 50 per cent of forest biodiversity and ecosystem functioning is dependent on the deadwood cycle. This is not only a nutrient issue but one of habitat, energy source, and biological webs. While nutrient losses can be mitigated through fertilization, loss of deadwood cannot be replaced. Thus large scale removal of wood is not a sustainable practice and has no natural model in Nova Scotia (B. Stewart, Pers Con. 2010).

Replanting of larger harvest sites has tended to favour softwood tree species. Often competing deciduous (hardwood) species are suppressed using herbicides. Maintaining a component of hardwood tree species is essential for recycling nutrients to soils and aquatic systems as a consequence of annual leaf fall. One of the roles of hardwood species following stand disturbance (natural or harvesting) is to access nutrients that are deeper in the soil profile (P. Neilly, Pers Con. 2010) as hardwood species have deeper rooting systems than softwood species. Eventually these pioneer (grey birch, pin cherry) or early successional hardwood species (aspen, red maple, white birch) are replaced with softwoods.

### The sustainable forest management challenge

While the Department of Natural Resources and some forest companies in Nova Scotia use expert site evaluation, geographic information systems (GIS), and productivity modeling to support sustainable harvest, assessment of specific soil chemistry, fertility levels, and limitations has not been completed across the very complex Nova Scotia landscape at a site level.

Many private land owners do not have access to such expertise and level of information, or may not wish to be involved with government forest management planning initiatives.

However, as demand and price for biomass increases, uninformed land owners could increasingly choose to harvest whole trees, removing essential organic material to the detriment of soil productivity, biodiversity, and quality forest regeneration in the long term.

Because of the large amount of privately held land in the province, its use in an informed sustainable fashion is essential to ensure biodiversity values for all Nova Scotians are protected. The critical message of preventing soil productivity depletion and biodiversity impact must reach private land owners (P. Arp, Pers Con. 2009). Inappropriate forest management may be the most significant threat to biodiversity in Nova Scotia (T. Herman, Pers Con. 2010).

### Objective

To manage forest tree harvest on working landscapes in Nova Scotia to ensure protection of biodiversity and heritage values essential for the long-term social and economic well-being of Nova Scotians.

### Recommendations

- Work with the forest industry and land owner associations, scientists, educational institutions and individual land owners to enhance science-based forest management and planning programs. Modern forest management planning should incorporate inventories using state-of-the-art remote sensing and GIS technology, biodiversity assessment, site-based harvest, and regeneration modeling. Application of nutrient sustainability management principles based on soil mechanics and chemistry information, drainage basin, surficial geology, and bedrock geology characteristics is essential.
- It is recommended that the practice of whole-tree harvest be deemed unacceptable.
- It may be desirable to implement regulations to ensure inappropriate whole-tree harvest practices are prohibited in Nova Scotia. Exceptions could include Christmas tree farms and agriculture management where post-harvest soil fertility maintenance using sustainable best practices could be practiced.
- The capacity to conduct ecosystem science, planning, and education for biodiversity protection and resource conservation must be enhanced in Nova Scotia. While the Department of Natural

Resources and other Government of Nova Scotia personnel are highly competent, notably dedicated, and adept at using teamwork between departments, much important work including research, planning, and public education cannot be addressed adequately due to limited staff capacity. The challenges of protecting biodiversity in context with sustainable resource management, including data collection, analysis, planning and education will become more complex as demand for forest products increases, and the effects of stressors such as climate change and acidification are better understood.

- There is a critical need to educate land owners, students, and the public about the importance of maintaining soil fertility on working landscapes in Nova Scotia to ensure maintenance of biodiversity values including healthy forest ecosystems, sustained quality tree production, and naturally productive aquatic systems. The responsibility to educate Nova Scotians about sustainable forest resource management lies not only with the government, but also with forest product and land owner associations, educational institutions, and non-governmental organizations.

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## **Appendix C: Biomass fuels: forestry, agriculture, and biodiversity**

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### **Background**

Harvest of biomass for fuels in Nova Scotia has the potential to substantially increase over the long term. Increasing export volumes of wood fuel products could create domestic wood supply shortages, displace employment associated with other forest industries, and impact forest biodiversity and productivity if unsustainable harvest is practiced on private and public lands.

The global pressure to reduce dependency on fossil fuels is driving increased use of renewable energy sources such as wind, solar, biomass, and tidal power in addition to hydroelectricity and nuclear energy. A carbon credit system is being developed that rewards states and industries for replacing fossil fuels with renewable resources.

### **Discussion**

The effective and sustainable use of forest and agricultural resources is important to the provincial economy in the short and long term. However, a significant proportion of Nova Scotia soils tend to be thin and vulnerable to depletion. The unregulated production and use of forest biomass for fuel could increasingly threaten our forest resources due to high demand from global energy markets. This could have significantly negative socio-economic and biodiversity consequences for the province.

The international carbon credit system will make importing biomass fuel commodities economically desirable for many developed countries wishing to displace petroleum use. Consequently, there is a potential for large increases in global biomass fuel consumption and price as petroleum reserves deplete. Foreign and corporate acquisition of private lands could also increase to secure potentially

lucrative renewable energy holdings.

This issue must be considered in context with the near and distant future, 50-to-100 years hence, or one-to-two forest-tree harvest rotations from present. There will be a significant decline in world petroleum production within a human generation. As offshore demand and global price for biofuel commodities increases because of declining availability of petroleum-based energy, Nova Scotia could face significant impact to rural communities dependant on traditional resident forestry businesses.

Large increases in forest biomass fuel export and increased commodity bid pricing could stress industries such as sawmills, paper production, and other value-added forest enterprises in Nova Scotia when a growing biofuel industry competes for trees with other forest product users. The level of automation in forest biofuel operations could result in less employment for forest workers when compared to enterprises including saw mills, particle board, and pulp and paper industries.

Concerns that corroborate the significance of this issue were expressed at an Eastern Canadian Forest Product Association Meeting in Montreal in 2007. While importing countries could get alternative energy credits for their use of imported wood products, Canada, as producer, apparently would not. Furthermore, increased fuel use could displace other forest uses and biodiversity values, as the pellet industry competes for tree fibre with other forest products users.

### **Domestic use of forest biomass as fuel**

Nova Scotia has set a target of 25 per cent for renewable resource use to offset fossil fuel use. Currently significant amounts of forest biomass in the form of hardwood logs are already used as a lower-cost alternative to heat Nova Scotia homes. Businesses are using waste wood (by-products from pulp and paper and sawmill operations) and harvested trees to generate heat and power at a local level. In the future, domestic wood fuel availability and cost could be impacted significantly by competing global market demand and pricing.



## Biomass production from an agriculture perspective

The forests are certainly not the only potential source of biomass fuels in our province. Certain agricultural crops are well suited to biomass production for fuels. Soil quality can be managed on farms more effectively through liming and fertilization to sustain primary productivity.

Farmers in Nova Scotia have long recognized the nutrient limitations of our soils featuring inherently low calcium levels in many areas, and subsequently managed for maintenance of fertility. The Nova Scotia Department of Agriculture provides management advice for individual land owners including soil nutrient analysis and planning services for pastures, livestock, and crops, including woodlot management.

While there is a need to define availability of agricultural capacity that could be committed to biofuel production, it is apparent that the potential exists. Certified field management plans that are based on tested chemical values, clear production objectives, and consideration for biodiversity/wildlife protection should be essential requirements for biomass production in an agricultural setting. The food production potential for Nova Scotia farms could be protected by licensing biomass production.

Introduction of inappropriate hybrid biomass crop species could become problematic if they became invasive in the natural environment. Sound, careful planning with input of expert Department of Agriculture crop specialists could minimize this risk to biodiversity.

## Conclusions

It is important that policymakers, land owners and the public understand the local and long-term global implications of increased forest biomass fuel production, and reduce risks associated with any unsustainable use of resource lands in Nova Scotia.

Care must be taken to ensure the wood supply interests of existing forest industries are addressed. Despite the occurrence of short-term global economic fluctuations, there will be a continuing need for quality timber from well-managed woodlands, and demand for wood fibre products for a broad variety of uses. Many rural communities in Nova Scotia depend on jobs and economic prosperity provided by sawmills and the pulp and paper industry.

There is potential to provide for biomass use from landscapes on Nova Scotia. However this capacity is somewhat limited, and should only be advanced when there is assurance that primary productivity potential of soils and the sustainability of our rural forest communities are not compromised.

## Recommendations

- Review strategic management policies and regulation requirements associated with forest biomass production in context with both long-term domestic and global biomass energy market demand projections.
- Adopt a precautionary approach when considering Crown land allotments for biomass fuel production to ensure wood requirements for other forest industries are not displaced, and sustainable wood supply limits are not exceeded.
- Require wood suppliers to forest-based industries to achieve management certification to ensure measured essential soil nutrients are sustainable and biodiversity values are protected on the landscape over the long term.
- Take steps to support fuel biomass production for domestic requirements within the agricultural sector where there is interest, available land, and the capacity to manage soil fertility.
- Develop and implement a renewed comprehensive education program that serves to inform land owners and the general public about the importance of sound resource conservation principles, including maintenance of soil productivity and biodiversity services.
- Continue to assess source options with respect to renewable energy production. Premature decisions without full consideration for renewable energy availability options could have serious consequences for future generations in Nova Scotia.

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